

IPv6

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Agenda items

- Proposed items:
 - GÉANT IPv6 update (Miguel)
 - 6NET update
 - GnomeMeeting IPv6 demo (Christian)
 - IPv6 and NTP (Laura)
 - GÉANT-6NET routing policies
 - IPv6 RIPE NCC TT server update
 - IETF IPv6 meeting report and discussion
 - IPv6 Multicast experiments (Stig)
 - IPv6 NREN Deployment White Paper (Cisco)
 - Future GTPv6 testbed deployment
 - Discussion of IPv6 deployment issues
 - Future TF-NGN IPv6 work items

GÉANT IPv6 update

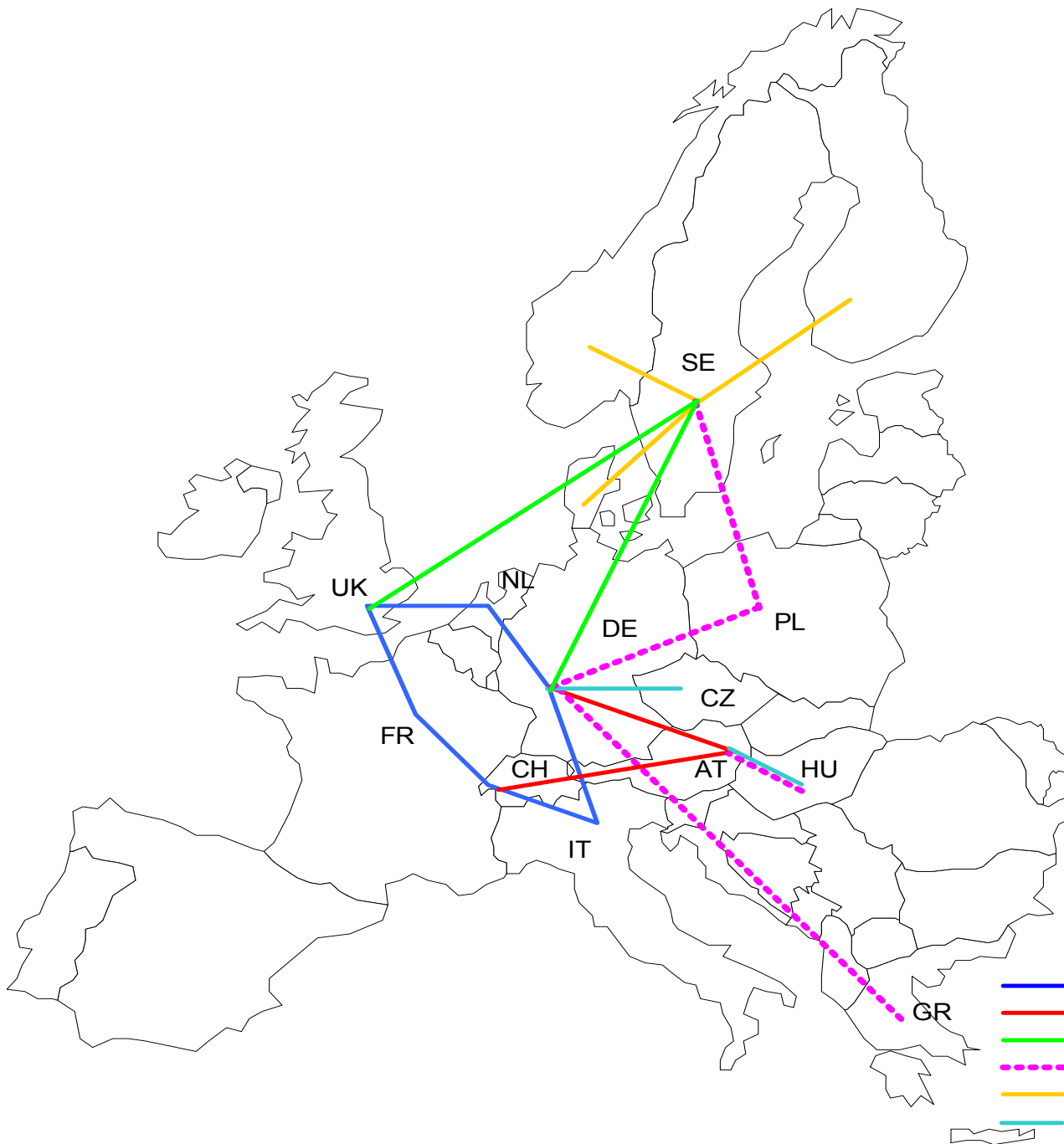
Miguel Angel Sotos, RedIRIS

6NET update

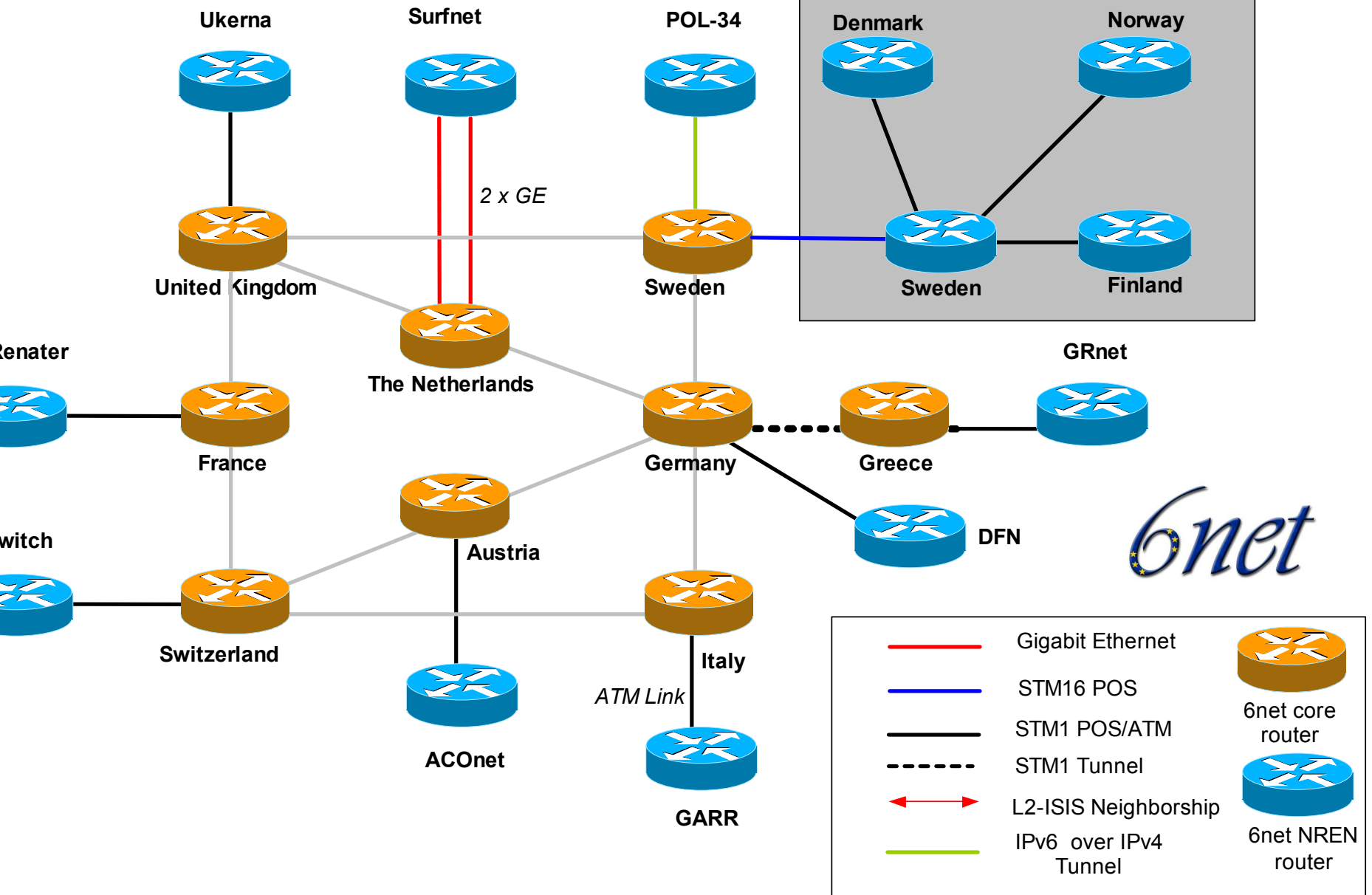
The *6net* project

- Deployed a pan-European IPv6 research network
 - Backbone in place since May 2002 at STM-1 line rates
- Project runs until December 2004
 - 1,100 man months between 35 partner organisations
- Many study areas beyond the basic network rollout, with 100 reports scheduled in 3 years
 - See: <http://www.6net.org/publications/>
- Desire to interconnect to international networks to further research goals through collaboration
 - Needs stable, reliable international routing

6net



NorduNET



6NET work includes....

- Services, including:
 - Multicast (initially 'm6bone', then native)
 - MIPv6 (initially over WLAN)
 - DHCPv6 review
- Transition methods and scenarios
 - Produce “cookbooks”, and input into IETF v6ops WG
- Applications
 - Streaming, conferencing, middleware, Grid, VoIP, ...
- Management and monitoring
 - Includes RIPE NCC Test Traffic servers
 - There is a production-like IPv6 NOC for 6NET

Recent 6NET activity

- Deliverables:
 - DHCPv6 investigation
 - Good example of work not published elsewhere
- New initiatives:
 - M6net
 - Multicast IPv6 over 6NET
 - EFT images to be tested on Cisco GSRs soon, depending on interfaces
- Project directions:
 - No upgrade from 155Mbit/s to 2.5Gbit/s
 - GÉANT offering high-speed IPv6
 - 6NET bandwidth usage not high (see <http://netmon.grnet.gr/6net.html>)
 - Releases funds (€450K) for other purposes/links

GnomeMeeting IPv6 demo

Christian Strauf, JOIN Project

IPv6 and NTP

Laura Serrano, RedIRIS

IPv6 Multicast

Stig Venaas, UNINETT

IPv6 Multicast issues

- Experience in tools and protocols very valuable
 - Gained from the m6bone – <http://www.m6bone.net/>
- Lack of inter-domain method for PIM-SM
 - No MSDP for IPv6
 - Proposal to embed RP location in multicast address
 - Probable wider use of PIM-SSM (which has no RP)
- Layer 2 snooping
 - MLD, MLDv2
 - May be important in wireless domains
 - May be better to have deeper routing than to use snooping

GÉANT-6NET routing policies

GÉANT and 6NET

- European NRENs are interconnected by GÉANT, offering a production IPv4 backbone service
 - Up to 10Gbit/s links, using Juniper routers
 - Includes a number of international links, e.g. to Abilene
 - Many NREN plans are in sync with GÉANT plans
 - Introducing a “production” IPv6 service in 2003
- 15 NRENs are members of the 6NET project
 - An experimental IPv6 research network, using Cisco routers
 - Deployed a native IPv6-only backbone in May 2002
 - Gaining useful experience for GÉANT and all NRENs
- Both networks are funded in part by the EC
 - 6NET deployment has accelerated GÉANT IPv6 deployment

Routing goals

- GÉANT:
 - Production IPv4 service
 - Introducing production IPv6 service
 - Includes dual-stack service on international links
 - Should be used for day-to-day IPv6 connectivity
- 6NET
 - IPv6-only backbone network
 - Experimental deployment
 - May run disruptive tests
 - Desire international connectivity for specific tests
- End sites may wish to use either infrastructure

Rise and fall of the 6bone

- The 6bone network has evolved over 7 years
 - See <http://www.6bone.net/>
 - It works, sometimes, but it is not reliable
 - People now demand a stable network for day-to-day use
- Too many ISPs offering transit over multi-hop tunnels
 - Many 6bone pTLAs “hobbyist” - collecting peerings for “fun”
 - They mistake a peering for a means of direct collaboration
 - But lack of reliability leads to more tunnelled peerings...
 - See the *draft-savola-v6ops-6bone-mess-01* Internet Draft
- Should seek tighter peering agreements
 - Apply policies, and include community tags in BGP peerings

Towards production networks

- The 6bone is being phased out
 - No more allocations after January 2004
 - No more use after 06/06/06.
 - See *draft-fink-6bone-phaseout-01* Internet Draft
- “Production” SubTLAs now easier to get
 - Allocated under 2001::/16.
 - We are seeing a growth in take-up of such allocations
- We wish to avoid the 6bone-isation of the production IPv6 networks in the 2001:: address space
 - We should think now to avoid problems ahead
 - Need high performance, with stable routing
 - Requires major transit providers to adopt IPv6 natively

International IPv6 routing

- Key international academic networks are now working together to get predictable, reliable international IPv6 networking.
 - Abilene
 - GÉANT
 - 6NET
 - Some NRENs (the Dutch, Finns, French, etc)
 - Euro6IX
 - WIDE (Japan)
- Using dual-stack (native) transatlantic links
 - Phasing out (problematic) long-haul IPv6-in-IPv4 tunnels

Rob & Duncan's summary

- Option 1: Separate network
 - Needs to be NREN-wide, thus expensive
 - Also needs separate ASN and IPv6 addressing
- Option 2: Default to 6NET
 - Use 6NET if communicating NRENs dual-homed
 - But 6NET tests may then impact production traffic
 - Changing routes during tests would be unwieldy
- Option 3: Use more-specific routes
 - Needs care to ensure non-aggregated routes do not leak
 - Could be signalled by use of BGP communities
 - General problem of different technologies, e.g. Multicast
 - NRENs won't run EFT images on production network

GÉANT policy

- GÉANT is connecting NRENs for IPv6
 - Using dual-stack IPv4-IPv6
 - Began April 2003, now ongoing
 - Just also connected to Washington (Internet 2)
- May offer additional free transit
 - Via Global Crossing and Telia
 - This traffic would not transit to 6NET
- Offer connectivity to IST projects via NRENs

6NET policy

- Primarily for test traffic
 - Has been used for “production” in absence of a GÉANT service, but that is now here :)
- Connecting NRENs (15 are in 6NET)
 - Also uses international links of the NRENs
 - SURFnet, Renater and NORDUnet
- Does not connect non-partner ISPs
 - Unless part of an IST project
 - Connectivity offered to IST projects
 - Used in IST2002, e.g. for 6WINIT demonstration

Current actions

- Expect NRENs will use GÉANT service in 2003
- Transition phase:
 - Connectivity points between GÉANT and 6NET
 - Offer transit connectivity until at least Q3 2003
 - Will carry NREN-only routes
 - 6NET NRENs should not pass these routes on
 - To be configured at up to 3 points depending on available and matching interfaces (STM-1/FE)
- Implementing traffic separation
 - Option 3 - more-specific routes - being adopted (D1.3)
- Connect IST projects on a case-by-case basis

IPv6 RIPE NCC TT server

IPv6 TTM Server

- First devices running February 2003
 - Uses FreeBSD system
- All new devices can be IPv6-enabled
- Existing devices can be upgraded
- Now 10 nodes connected
 - Includes SURFnet, Southampton, HEAnet, Vienna, SWITCH, Estonian Telephone Company
- Very useful data
 - Usual OWD measurements
 - Also keeps historic traceroute paths - very handy for checking routing changes over time.

IETF IPv6 meeting report

Highlights from IETF#56

- IPv6 WG - Deprecation of unicast site-local
- 6bone BoF - Winding down the 6bone by 06/06/06.
- IPv6 Operations WG - four scenarios, plus mech doc
- DHC WG - DHCPv6 going to RFC status
- Mobile IP WG - MobileIPv6 going to RFC status
- DNSop - DNS discovery, reverse lookup population
- Mboned - IPv4-IPv6 gateway, embedded RP address
- Nsiim - Next steps in IP mobility BoF

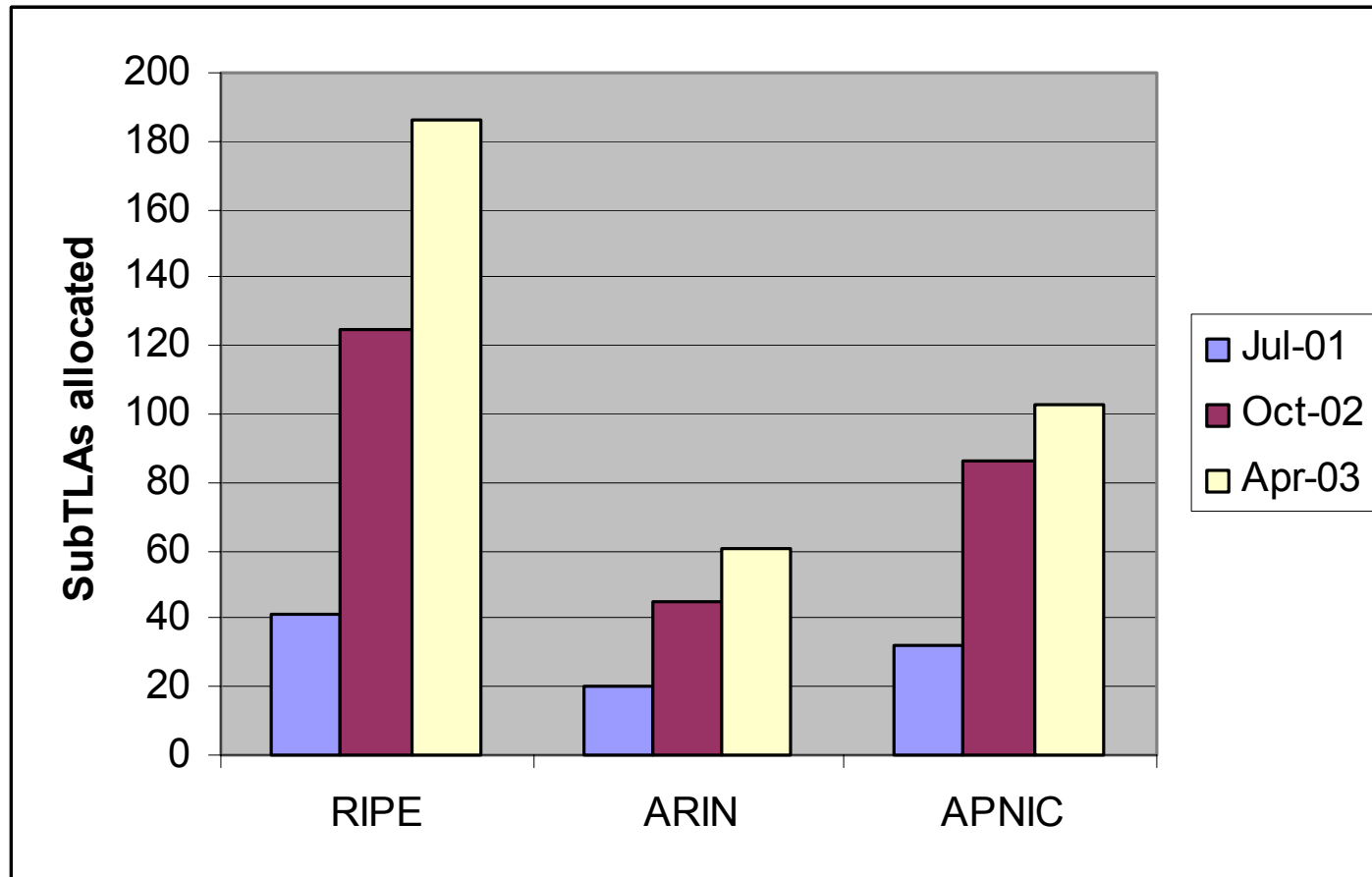
IPv6 NREN White Paper

White Paper request

- Came from
 - Mallik Tatipamula <mtatipam@cisco.com>
- Aimed at
 - Public audiences
 - Cisco internal staff
- Key interest may be Renater and SURFnet
 - And GÉANT and Funet if the paper is not Cisco-only :)
- Email Mallik if you wish to contribute
 - IPv6 Deployment in your NREN.

IPv6 Deployment Issues

Allocations of SubTLAs



NREN next steps....

- The key is to bring the universities online
 - Transition strategies and cookbooks for NRENs
 - But users want applications, not IP versions
 - Remember there is no mandate for universities to deploy
 - But no commercial case is required either
 - Early interest probably in Computer Science departments
 - IPv6 is being taught, thus IPv6 desirable in the CS classrooms
- Showcase studies to promote the technology
 - Possible FP6 projects, e.g. wireless campus
- Build and encourage national communities
 - Avoid fragmenting the IPv6 user base

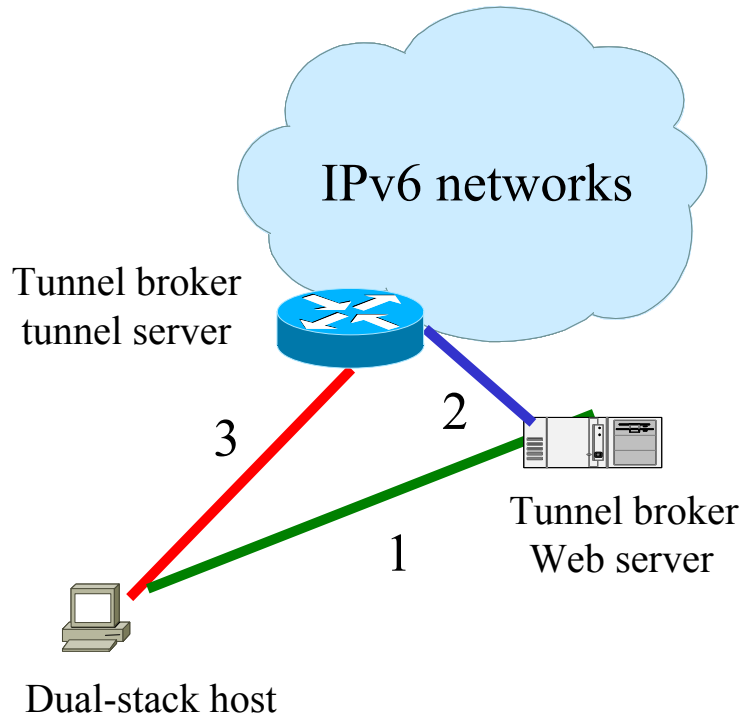
Site deployments




- Some universities running IPv6 services
 - Almost all those doing so are using dual-stack
 - Can, for example, carry IPv6 traffic in existing IPv4 VLANs
- A small number of IPv6-only networks
 - Very much at the vanguard at present
- See 6NET deliverables:
 - <http://www.6net.org/publications>, for “cookbook” texts
 - In particular:
 - Deliverables D2.1.1, D2.2.1, D2.3.1, D2.2.2 and D2.3.2
 - D2.3.1 describes the Tromsø IPv6-only wireless IPv6 network
 - These will be updated during 6NET’s lifetime

Connecting isolated users

- Staff or students wish to gain IPv6 connectivity
 - At home, in student halls or shared accommodation
 - May be behind an IPv4 NAT router
 - Visiting other networks (conferences, etc)
- Common options
 - Manual tunnel to university network
 - Requires cooperation at the university end
 - Tunnel broker service to university or other network
 - Automated, and may also be authenticated
 - Use of 6to4
 - Requires a 6to4 relay, which may be problematic

Tunnel broker usage



- 1  User connects to web server requesting tunnel
- 2  Web server returns script to create tunnel to the tunnel server, and informs tunnel server of new client
- 3  Client activates script, and gaining access to IPv6 networks via the tunnel server

Connectivity considerations

- May need to overcome IPv4 NATs
 - Can use a tunnel broker if a global IPv4 address is available
 - May need to also do Protocol 41 forwarding in the NAT box
 - Helps to have a static IPv4 address
- May need firewall changes
 - Enable Protocol 41 (to allow the IPv6-in-IPv4 tunnel)
 - Potentially a security risk if this creates a back door...
- Need to consider routing efficiency
 - Do not want to use a Canadian tunnel broker while in the UK
- May have other security concerns
 - e.g. DoS attacks on a 6to4 relay

Missing pieces for deployment

- NRENs identifying issues from experience
 - Basic services generally working well
 - But a number of IPv6 required features are still lacking
- OS and router implementations improving
 - Many vendors now have good IPv6 support out of the box
- General areas to consider for IPv6 include:
 - Network robustness and performance
 - Network management
 - Application and IPv6-specific features
 - Security considerations
- See 6NET Deliverable D2.5.1

Future GTPv6 testbed trials

What do we wish to do?

- Have:
 - Juniper M5, hosted by Renater
 - Hitachi GR2000, hosted by Southampton
 - The new GÉANT testbed
 - Offers of connectivity to Alcatel routing equipment
 - The 6NET experimental network
 - AS8933, and the 6bone 3ffe:803c::/28 prefix
- Tests?
 - Multicast - PIM-SSM?
 - Interoperability?
 - What is outside scope of 6NET
 - Or of interest to non-6NET NRENs?

Future TF-NGN IPv6 work

Future work?

- Continued “think tank” presence
- Much happening on GÉANT and 6NET
- But not all NRENs in 6NET
 - Much good work outside 6NET
 - For example IPv6 Land Speed Record :)
- Suggestions welcomed...
 - Going beyond basic dual-stack service on GÉANT
 - What concerns the NRENs?
 - What concerns the end sites?